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Do minimum wages matter for earnings inequality? Evidence from large increases of minimum wage in Russia (2005-2015)[2]

The available minimum wage literature is mostly based on evidence from developed countries or developing countries of Latin America. Little empirical work has been done on the effects of minimum wages in transition economies, where labour institutions experienced rapid changes and law enforcement differs in many important ways. This paper presents an empirical evidence on minimum wage effects for Russia, the largest transition economy. I use regional variation in the relative level of the federal minimum wage to identify the impact of large increase in the real value of the minimum wage on the Russian wage distribution between 2005 and 2015. The analysis suggests that the minimum wage can account for the bulk of the decline in the lower tail inequality, particularly for females.

Keywords: minimum wages, wage distribution, transition economies, Russia
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1. Introduction

The minimum wage literature contains limited evidence concerning former state socialist economies which are quite distinct from both developed and developing countries. The existing literature for developed countries shows that minimum wages narrow the wage distribution and have a small or insignificant adverse effect on employment (Neumark and Wascher, 2007). Studies for developing countries, which are mostly based on evidence from Latin America, suggest that wage compression effects are larger in those countries but often disagree on the magnitude of employment effects (Gindling and Terrell, 1995; Maloney and Mendez, 2004; Lemos, 2009). Very few studies have attempted to estimate minimum wage effects in transition countries. Ganguli and Terrell (2006) use data for Ukraine and employ kernel density techniques to study the impacts of minimum wages on the wage distribution in 1996-2003. By 2003, the minimum wage in Ukraine reached 40% of the average wage. Ganguli and Terrell demonstrate that the minimum wage hikes played an important role in lowering the growth in inequality, more for women than for men. Kertesi and Köllő (2003) use data for Hungary and find that a significant increase in the minimum wage (57% in nominal terms) caused significant job losses in small firms despite widespread non-compliance. Lin and Yun (2016) show that changes in the minimum wage policy in China helped to reduce inequality at the bottom of earnings distribution. Kecmanovic (2012) reports a dampening effect on men's wage inequality in Serbia. Ferraro et al. (2018) find substantial spill-over effects of minimum wage increases in Estonia.

Russia provides a good case to study the impact of minimum wages on wage inequality and employment, as the country experienced a dramatic rise in minimum wages in a recent decade. Over a decade between 2005 and 2015, the statutory federal minimum wage increased by a factor of 5.4 in nominal terms and by a factor of 3.6 in real terms. After more than a decade of being merely symbolic, minimum wages reached 25% of the average wage in Russia and became binding for certain types of low-wage workers. Previous research on minimum wage in Russia report adverse effects of minimum wage increases associated with lower youth employment and greater informality (Muravyev and Oshchepkov, 2013, 2016). The estimated effects are statistically significant but are very small to be economically significant. Kapelyuk (2015) finds slight poverty-reducing effects of minimum wage increases in Russia.

This paper aims to fill this gap and estimate the impact of minimum wages on the distribution of wages in Russia. I use the methodology developed by Lee (1999) and later refined by Autor et al. (2016). This identification builds upon an observation that the effects of minimum wage policies are more pronounced in low-wage regions than in high-wage regions. It uses the cross-region variation in the gap between the minimum wage and the median wage to estimate a counterfactual wage distribution that would have existed in the absence of the minimum wage.

Applying this model to a regionally representative dataset from Russian workers employed in the corporate sector, I find that the minimum wage can account for the bulk of the decline in the lower tail inequality, particularly for females in 2005-2015.

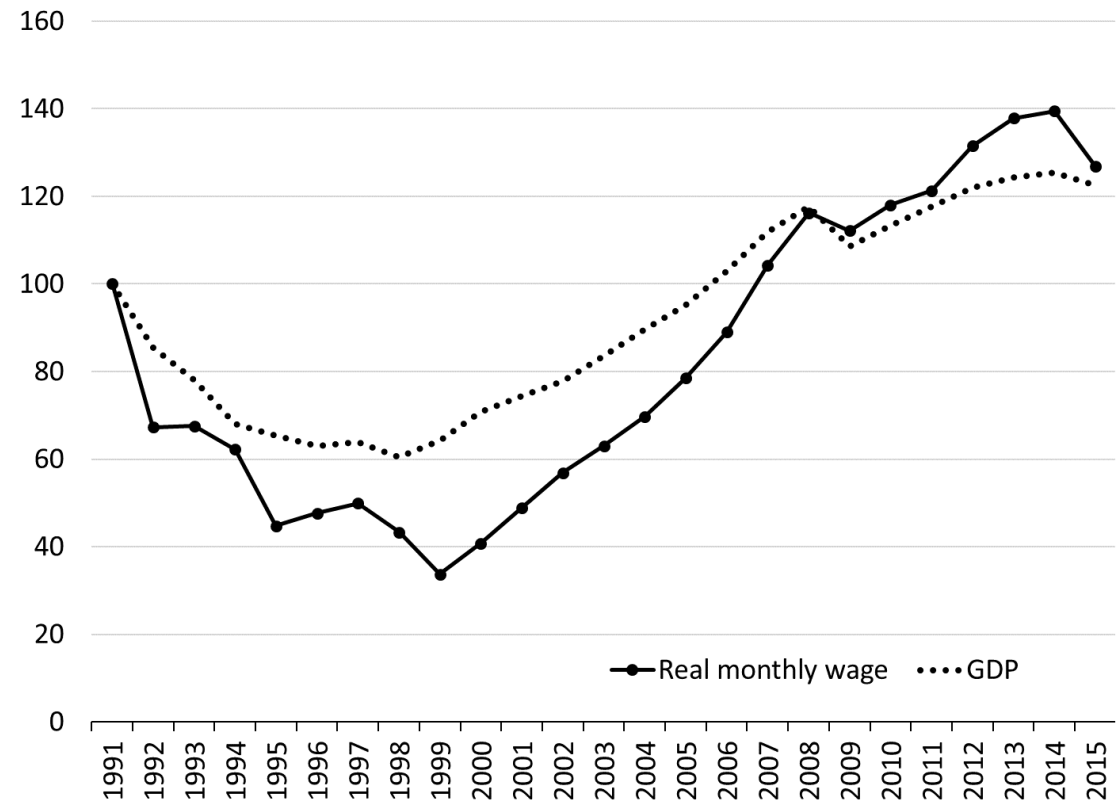
I show that the impact goes far beyond the 'neighbourhood' of the minimum wage and produces significant spillover effects. The average regional spillover effects persist up to the 30th percentile of the female wage distribution. These spillover effects should be accounted for when designing the minimum wage policy.

The paper proceeds as follows. Section 2 describes the key features of wage adjustment and the role of minimum wages in the institutional framework of the Russian labour market. Section 3 discusses the data and its appropriateness for the goals of this research. Section 4 proceeds with descriptive analysis. Section 5 presents the methodology for estimating causal effects of the minimum wage on wage distribution. Section 6 estimates a set of specifications based on different identification assumptions. In Section 7 I construct counterfactual wage distributions, holding the real minimum wage constant. The final section concludes.

2. Wage adjustment and earnings inequality in the Russia's transition

Russia experienced a radical change in its political and economic structures during the last two decades. Its transition from a command economy to a market economy began with a radical set of reforms in 1992 known as 'shock therapy'. Major reforms included price liberalization, mass privatization, and liberalization of foreign trade. The subsequent period encompasses severe transformational recession followed by dynamic economic recovery and rapid improvement in labour market performance. In 2008, Russian economy was sharply hit by the financial crisis, but the downturn was quite brief. Another shock came with the deep fall in global oil prices and sanctions regime imposed in 2014 triggering a new recession.

Most of the labour market adjustment was acted out through wages, which were extremely flexible during this time. Fig. 1 shows the evolution of GDP and real wages. During the 1990s, real wages fell to one-third of the pre-transition level. In the 2000s, Russia experienced a sustained growth of real wages at a rate that exceeded that of output growth. Real wages grew by 10-15% annually between 1999 and 2008 and tripled over this period so that the level of 1990 was surpassed in 2007. In most recent years the growth of real wages was slow and fragile with sizable drops in the aftermath of the 2008 and 2014 crises.



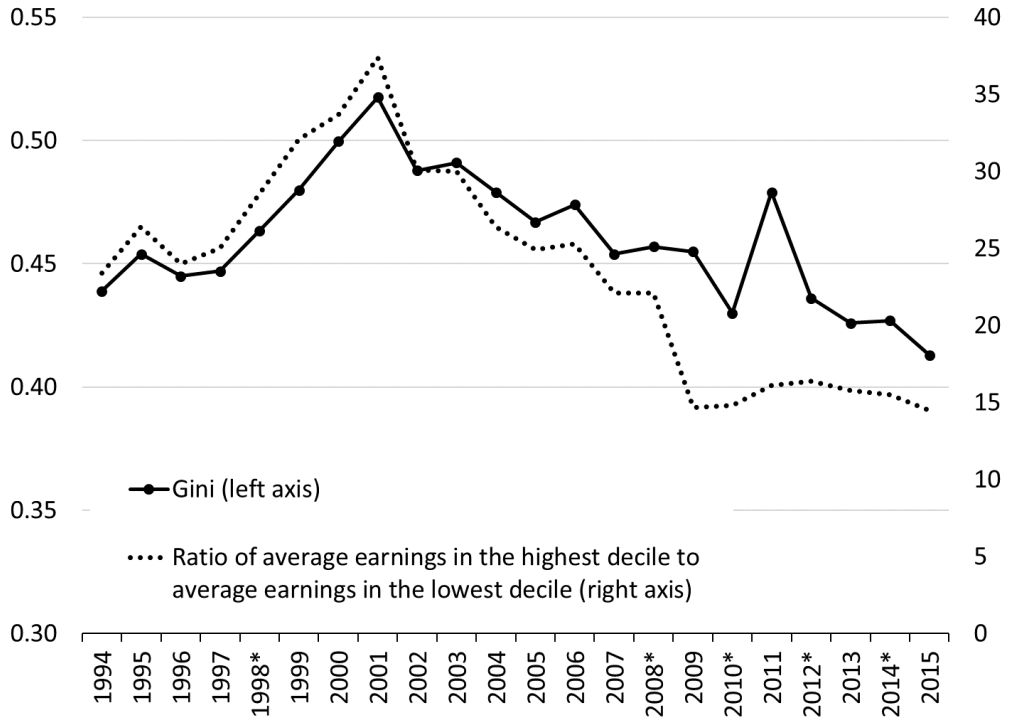
Source: Rosstat

Fig. 1. GDP and real wages (1991 = 100)

The introduction of market reforms led to an immediate widening of wage distribution. Before the start of the transition process, the level of inequality in Russia was fairly low by international standards. An abrupt increase of earnings dispersion was observed in the first years of economic transition approaching the levels of Latin America (Brainerd, 1998; Flemming and Micklewright, 1999). Inequality increased along the whole distribution, but the bottom half expanded more than the top half. The peak of inequality was recorded soon after the 1998 crisis, since then inequality has been declining (Fig. 2). Importantly, wages grew faster at the bottom of the distribution.

Previous research concludes that that is no single reason for the observed changes in earnings inequality. Increases in returns to education and growing occupations premiums contributed to the rise of inequality in the early transition period. It was not surprising because wage differentials had been compressed under socialist egalitarian policy. However, most of increase in inequality occurred within narrow skill groups. This increase reflected a transitory disequilibrium needed to encourage industrial and labour reallocation restructuring as well as monopolistic structure of product markets. Large rents became available to some firms in certain industries and regions especially in mining and financial intermediation. Some firms continued to exercise a substantial degree of market power, and managers shared rents with workers. Macroeconomic uncertainty, high inflation, limited geographical mobility of population, big size

of the country, and soft budget constraints of state-controlled enterprises slowed the arbitraging of excessive rents. All researchers agree that that labour market institutions are largely responsible for the observed wage flexibility and rising (and subsequent decline) of wage inequality. Brainerd (1998) highlights the role of falling real value of the minimum wage and lack of formal bargaining in the very first years of transition. Clarke (2002) argues that decentralization of wage-setting, weak trade unions and broad managerial discretion to make decisions regarding pay are key drivers of rising wage dispersion. Lehmann and Wadsworth (2007) investigate patterns of wage arrears and report that earnings inequality could be 30 % lower in the absence of arrears. Calvo, Lopez-Calvo and Posadas (2015) explicitly relate the compression of wage distribution in the 2000s to active minimum wage policy implemented since 2005. They find it to be a single most important factor of inequality decline at the bottom of distribution between 2002 and 2012 explaining more than 40 % of reduction in the 50-10th percentile log wage differential.



Source: Rosstat. * - no survey, estimates by the Rosstat

Fig. 2. Earnings inequality

Unemployment benefits normally serve as a wage floor that constrain downward wage flexibility. Unemployment benefits have never been generous in Russia. Different from many Eastern European countries, the unemployment benefits were initially set at a low level in Russia. At its peak in 1998, the ratio of average unemployment benefit to average wage reached 30% but then gradually decreased to less than 10% (Gimpelson and Kapeliushnikov, 2011).

Therefore, unemployment has never been an attractive option and unemployment benefits were not likely to exercise upward pressure on the wage floor.

3. Minimum wage policy in Russia

Minimum wage legislation was established in the USSR in 1976 and continued to exist after the collapse of the USSR. The value of the federal minimum wage is set by the government and approved by based on tripartite through the bargaining between trade unions, the government, and the parliament. This process takes into account budget revenues and domestic politics but largely disregards labour market considerations. In practice, the government makes the decision on minimum wages while other parties have only a weak voice (Vishnevskaya, 2007). The federal minimum is legally binding and covers all full-time employment contracts. It is not differentiated by age groups, occupation categories, branches of economic activity, establishment types, ownership, or firm size.

The major reform of the statutory minimum wage was undertaken in 2007. It changed the list of payments to be covered by the minimum wage regulation and introduced regional minimum wages. Before 2007 the minimum wage related to gross monthly earnings net of mandatory regional wage supplements, shift pay, other bonuses and compensations (hereafter, for convenience we will call this wage concept the "tariff" wage). Since 2007 the minimum wage legislation has been applied to the total wage amount, which includes all bonuses and compensations. However, the tariff wage in Russia often constitutes only a small part of total earnings and the Labour Code does not explicitly define what components count towards compliance with the minimum wage.

Before 2007 legally the federal minimum wage was the same for all workers in all regions, but in fact it varied from one region to another because of mandatory "northern" coefficients. These northern coefficients were introduced in the Soviet times and aimed to provide different levels of compensation for workers depending on the location of the job. The value of the regional wage coefficient ranges from 1.0 (no extra regional compensation) in central Russia to 2.0 (triple the base wage) in Chukotka[3]. Additionally, northern coefficients vary within regions, across industries and occupations. According to some estimates, in total 577 normative documents regulate application of the northern coefficients some of which relate to specific establishments or are adopted by local authorities. Most of these normative documents were enacted before the collapse of the USSR but remain in force. Being applied to tariff wages, the northern coefficients generated multiple wage minima for different locations.

[3] The system of regional compensations in the USSR and Russia is described in some detail in Berger *et al*. (2008).

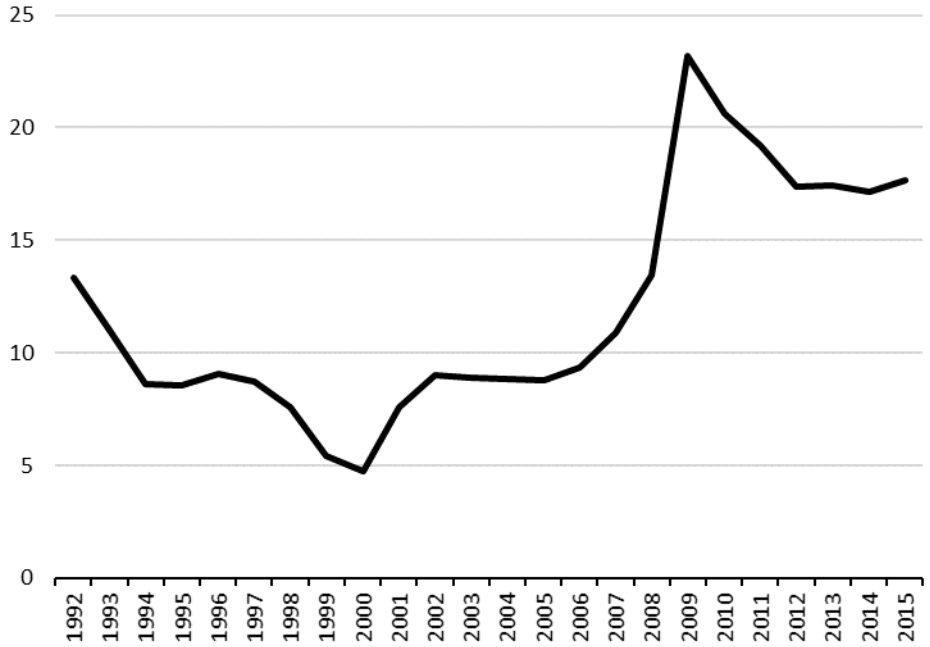
Since 2007 the federal minimum wage has been applied to the total wage amount regardless of the location of the job[4]. Therefore, the new system of minimum wage fixing does not have mechanisms for automatic adjustment for regional conditions. Instead, regions were allowed to set their own minimum wages above the federal minimum. Regions were given much discretion in deciding the amount and the coverage of the regional minimum wage. By October 2009 about one-third of Russian regions had adopted regional minimum wages, but in half of them the regional minimum wage was set to cover only the private sector. In 2015 more than 60 regions had regional minima (out of 83), but only 25 regions had equal minima for the private and the public sector (Lukiyanova, 2016).

For the regions that have adopted the regional minimum wages, enforcement is often questionable. There are some loopholes in the law that allow populistic authorities introducing regional minima with no enforcement obligations. Formally, the Labour Code specifies that regional minima should be set via special collective agreements on regional minimum wage between trade unions, employers organisations, and regional governments. These collective agreements are automatically extended to all workers employed in the region and are enforced by local labour inspectorates. If an employer is incapable to cope with a regional minimum, she has to ask for a formal approval from a special commission. Such appeals are extremely rare and often stay unsatisfied. However, in some regions minimum wages are set via general collective agreements at the regional level. These collective agreements have no formal extension mechanisms and apply only to workers of the signatory parties – to workers-members of the signatory unions and firms-members of the signatory employers' organisations. Importantly, the minima negotiated in general collective agreements are not subject to enforcement by labour inspectorates. The number of regions with minimum wages "set" by general collective agreement was equal to 10-12 in 2009-2015 (Lukiyanova, 2016). The composition of this group is not constant: some regions use general collective agreement as a "stepping stone" to more inclusive arrangements.

[4] In December 2017, the Russian Constitutional Court ruled that minimum wages should be applied to the wage net of all compulsory amendments such as regional allowances and compensations for dangerous work. De facto, this decision prescribes to apply the minimum wage to the tariff wage and restores the pre-2007 system that regionalized the statutory minimum wage through multiple "northern" coefficients. Before this decision was taken, trade unions insisted that only tariff wages should be taken into account for the purpose of minimum wages and that compulsory amendments should not count towards compliance with the minimum wage. Employers argued that minimum wages should be applied to total remuneration. Courts tended to back employers in minimum wage labour disputes, but this practice was not universal. The Supreme Court issued several ambiguous rulings on the composition of minimum wages in 2010-2011. The last ruling of the Supreme Court favored employers' interpretation of the law. The Constitutional Court took position of trade unions in 2017. The decision by the Constitutional Court put a final word on public debates and contradictory court decisions on individual cases on what the minimum wage should include. However, for the period under consideration the composition of the minimum wage was subject to discussion.

According to the law, the minimum wage should exceed the minimum subsistence level calculated on the basis of the minimum consumption basket for a working-age individual. However, this provision has never been enacted[5]. Over the transition period the Russian minimum wage has been below the minimum subsistence level. Indexation has been held on a discretionary basis with no regularity in the recommendations of the government.

Economic recovery and the rapid rise of oil prices improved budget conditions. Significant steps have been made to reduce the direct and indirect effects of future increases in the minimum wage. The Unified Tariff Scale was gradually replaced with a more flexible system with weaker ties to minimum wage standards. The reform of the minimum wage setting mechanism decoupled it from the social security system and administrative fines.



Source: Rosstat

Fig. 3. Minimum wage as % of average wages

Since 2000 the minimum wage has been more and more widely used as a social policy tool (Fig.3). In 2000 it was set at 132 RUB a month and was regularly indexed. But in spite of indexation, until mid-2007 it fluctuated around 8% of the average wage. In mid-2007 and early 2009 the minimum wage was substantially increased. Both times, it nearly doubled. In September 2007 it rose from 1100 RUB to 2300 RUB. In January 2009 it was further increased to 4330 RUB, reaching the level of 25% of the average wage. Since 2009, the pace of wage increases slowed down. In real terms, the federal minimum wage was lower in 2015 than in 2009.

[5] The federal minimum wage was tied to the minimum consumption basket since May, 2018, which is beyond the period considered in this paper.

In this paper I examine the impacts of these recent increases of the federal minimum wage on earnings inequality. Official estimates of wage growth by deciles of the earnings distribution suggest that since 2002, wage growth occurred more rapidly at the bottom of the distribution (Fig. 4). Moreover, wage growth at the low end has substantially accelerated since 2007. Over the period 2000-2015 the average real wage in the lowest decile increased by a factor of 7 while the in the top decile it 'just' tripled.

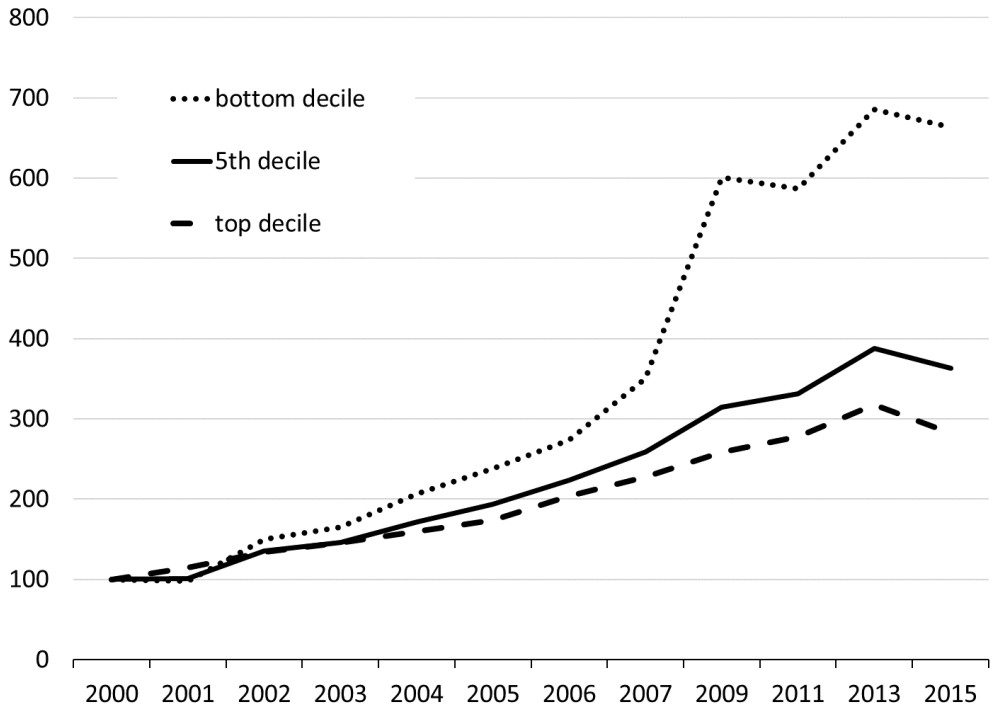


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Fig. 4. Evolution of real wages in different parts of the distribution (2000=100%)

4. Data

The data come from the bi-annual Survey of Occupational Wages carried by the Russian Statistical Office (Rosstat). I use the rounds of the survey administered between 2005 and 2015. In each round, the reference month of the survey is October. Over the period under consideration, the federal minimum wage grew from 800 RUB to 5,965 RUB and was indexed ten times. Thus, using data from 2005-2015 is potentially illuminating, as the federal minimum wage rose over the period by a factor of 7.5 in nominal terms and by a factor of 3 in real terms.

The Survey of Occupational Wages is an establishment survey. It first samples establishments and then workers within establishments. Data on wages, worker characteristics, and establishment characteristics are provided by the establishments. This minimizes the number of missing observations and reporting errors that are common in household surveys. Large- and

medium-size establishments from all branches of economic activity are sampled with notable exceptions for agriculture[6], public administration, and financial intermediation. The survey covers only workers who worked full-time in the reference month. The samples are very large – about 700,000 for each round – and representative at the regional level for all Russian regions[7]. Another unique feature of this dataset is that it distinguishes between tariff wage, mandatory regional wage supplements, and other bonuses and compensations. This distinction is very important because before 2007 the minimum wage was applied to the tariff wage. All these features make the survey of occupational wages a particularly appropriate data set for the study the effects of minimum wage increases in Russia.

Of course, potential drawbacks also have to be considered in connection with the use of the Survey of Occupational Wages:

- The data do not cover the informal sector, small-sized firms, and agriculture. This is the segment of economy where firms are least likely to be in compliance with legislation. Wages are likely to be lower and more dispersed. However, studies on Latin America and on the uncovered sector in the US document that in practice the minimum wage is paid in both the formal and informal/uncovered sectors (Brown, 1999; Maloney and Mendez, 2004; Lemos, 2009). Empirical evidence suggests that non-compliance with the labour regulations is observed in other aspects of the labour contract, such as social security taxes, flexible hours, firings, etc. (Amadeo and Camargo, 1997). Furthermore, I can only speculate about crowding out effects on employment caused by the minimum wage increases. Workers could lose their formal sector jobs and move to the informal sector in response to minimum wage increases. Official statistics does not confirm that this was the case, as the proportion of those employed in the informal sector remained stable over the period. According to the Rosstat, informal sector employment amounted to 17.6% of total employment in 2005 and 20.5% in 2015. Apart from the minimum wage hikes, there have been other reasons for the informal sector expansion. The growing informal economy has been observed since the early 2000s when the Rosstat started to collect the relevant data in labour force surveys.
- The doubling of the minimum wage in 2009 coincided with the economic crisis. The decision about raising the minimum wage in January 2009 was made in June 2008, shortly before the start of the crisis. However, it was not cancelled in the end of 2008

[6] Agriculture was included into the sampling frame in 2013. We exclude all workers employed in agriculture to ensure comparability over time.

[7] We drop observations for Chechnya because data on Chechnya are missing in 2005 and 2007. We also exclude observations for Crimea and Sevastopol that appear only in 2015, and all observations for Arkhangelsk oblast' and Tyumen' oblast' due to inconsistences in aggregation of the data for autonomous districts within these regions across the surveyed years.

when it became clear that Russia was hit hard by the crisis. To combat the labour market consequences of the crisis the Russian government introduced an anti-crisis package in early 2009. The programme was focused on public and temporary works schemes both for unemployed people and for employed people who were at risk of dismissals (mostly workers on reduced working time). The proposed scheme included income support exactly at the level of the minimum wage (plus mandatory regional wage supplements) to the programme participants. Workers on reduced working time could additionally enjoy part of their normal wage for the time actually worked. In the survey data it is not possible to differentiate between programme participants and ordinary workers. Therefore, I cannot give an idea of how the anti-crisis active labour market policy (ALMP) could affect the proportion of workers at the minimum wage. However, according to official estimates, the peak fraction of ALMP participants never exceeded 1% of corporate employment. The programme was abolished in the end of 2010.

Table A1 in Appendix presents some descriptive statistics. More than a half of the surveyed workers are employed at state and municipal establishments. This fraction is high compared to the economy average (about 30% for the period under consideration), but due to sample design all state and municipal establishments are included into the sampled population. The largest groups of survey participants are concentrated in three types of economic activity – education, manufacturing and health. The structure of the sample reflects some important changes in Russian economy – increasing educational attainment and falling importance of manufacturing. Over this period, the fraction of university graduates increased by 11 percentage points. The share of manufacturing decreased by 4 percentage points.

5. Descriptive analysis

The wages variable used is monthly gross real wages. I deflate wages using the Consumer Price Index, using October 2005 as 100. Sampling weights are used in all calculations. Average real wages rose over the period, especially rapidly between 2005 and 2007 before the wage growth was suppressed by the crisis (Table 1). The global financial crisis affected real wages, but the effect is smoothed since the survey was not held in 2008. However, we observe negative consequences of the 2014-2015 recession reflected in the fall of real wages in 2015.

In 2005[8], the minimum wage represented 10% of the value of average wage and 21% of the value of the average unskilled wage (computed over workers in elementary occupations – ISCO-

[8] The survey does not contain information on job geolocation. Consequently, for 2005 we correct minimum wages for the lowest value of northern coefficient applicable in the respective region which is equal to 1,0 for most regions. From 2007 onwards minimum wages are not corrected.

9). At the peak – in 2009 – these ratios increased to 25 and 53 % respectively. Despite modest nominal increases, the real value of the minimum wage has been declining since 2009. By 2015, they went down to 18 and 39 % mainly due to nearly "freezing" of minimum wage increases in 2009-2015.

Fig. 5A (in Appendix) plot kernel distributions for log real wages and log real tariff wages. A vertical line is shown at the level of corresponding federal minimum wage. The most striking feature of Fig. 5A and 5B is that a spike at the minimum wage level was not observed in 2005, substantially grew in magnitude by 2009 and then bounced back in 2013-2015. The spike is more evident in the distribution of tariff wages. In 2005 it was small and close to the bottom of the distribution. By 2009 it moved towards the centre of the distribution. It may signal that because of uncertainty of regulation in 2007-2015 many establishments continued to follow an old definition of the minimum wage, relating it to the tariff wage rather than to the total wage. It is likely that the link between the minimum wage and the minimum tariff wage was fixed in collective agreements at the enterprise level.

Table 1. Federal minimum wage (FMW), average wages, and bindingness of the FMW

	2005	2007	2009	2011	2013	2015
Nominal FMW, RUB	800	2300	4330	4611	5205	5965
Real FMW (2005 prices), RUB	812*	1885	2830	2665	2642	2415
Real mean wage (2005 prices), RUB	8324	10722	11472	12754	14453	13195
Real mean tariff wage (2005 prices), RUB	5149	6793	7632	7998	8913	8088
FMW/mean wage for all workers, %	9.7	17.6	24.7	20.9	18.3	18.3
FMW/mean wage for the least skilled workers, %	21.3	38.0	52.8	44.6	38.8	39.1
Fraction at MW-1 (total wage), %	0.3	1.4	4.2	0.1	1.0	0.0
Regional variation in fraction at MW-1:						
Minimum	0.0	0	0.0	0.0	0.0	0.0
Maximum	3.1	18.1	23.2	1.9	15.1	1.2
Fraction at MW-2 (tariff wage), %	1.1	7.8	14.0	10.2	9.6	9.0
Regional variation in fraction at MW-2:						
Minimum	0.1	1.2	0.6	1.0	0.8	0.0
Maximum	3.8	29.2	47.9	48.0	47.2	54.4

Note: * - the lowest northern coefficient applicable to each region is used.

The size of the spike, the fraction below or at minimum wage (fraction at MW), is shown in Table 1. This measure indicates the degree of "bindingness" of the minimum wage. Being applied to total wages ("fraction at MW-1") it increased over 2005-2009 from 0.3% to 4.2% of all workers. Generally, the minimum binds well below the 10th percentile.

In 2011-2015 both fractions dropped following the drop in the real value of the minimum wage. The drop in the fraction at MW-1 can also be explained by increased enforcement. By the law, enforcement of the minimum wage is an obligation of labour inspectorates that are notorious for being understaffed, low efficient, and corrupted. Labour inspectors can only detect cases of non-compliance during prescheduled or complaint-initiated inspections wage-related inspections. In the late 2000s the Federal Tax Service got rights to establish special wage commissions at the regional levels that are responsible to detect low paying establishments and put pressure on them to increase wages. The Federal Tax Service is much more efficient in enforcement as it collects data on all wage payments. In 2015, compliance with the minimum wage legislation became almost complete in Russia, at least in the corporate sector covered by the survey.

Regional variation in the "bindingness" of the minimum wage was considerable for both measures in 2005 and increased dramatically over the period. The proportion at MW-1 based on total wages varied from 0 to 1.6% in 2005. By 2009 the regional maximum increased to 23.2%. This means that at least in some regions the minimum wage has become binding at sufficiently high percentiles. For latter years the maximum for the fraction at MW-1 is volatile and sensitive to the situation in a single region (Republic of Dagestan). For the fraction at MW-2, results are even more striking as the regional maximum went up to 54.4% in 2015. Based on this measure regional variation in the "bindingness" of the minimum wage does not appear to decline since 2009.

Introduction of regional minimum wages have moved the wager floor in some regions. In the previous section we described the difficulties in defining the regional minima. According to the Labour Code workers in federal establishments are exempt from regional minimum wage regulations. Apart from that many regions set separate minima for the public and private sector workers, some regions introduced their minima via general collective agreements with limited coverage. To address these issues, we calculate regional minima as a weighted average of regional minima applicable to different groups of workers (federal minimum – for federal workers, sector-specific minima for local public and private sector workers). We employ only minimum wages set via special regional minimum wage agreements and ignore those set via general collective agreements. For 2005, regional minima are set equal to the federal minimum corrected for the lowest northern coefficients applicable to respective regions.

Table 3 shows the evolution of regional minimum wages. A growing number of regions adopted regional minima that exceed the federal level between 2007 and 2015. The coverage of the newly adopted minima is often limited to the private sector. Regional and municipal public sector workers are covered by regional minima in much fewer regions. Some regions that introduced higher minima for both sectors still have two different levels for the private and

public sector workers. The gap between the regional and federal minimum for the average worker is modest. However, there are some differences in trends. The real value of the average regional minimum peaked in 2013 and by 2015 it still exceeded the level of 2009. The "bindingness" of the regional minimum wages does not differ much from that of the federal minimum implying that regions with higher average wages were more likely to pursue independent minimum wage policy.

Table 2. Regional minimum wages (RMW)

	2005	2007	2009	2011	2013	2015
Mean RMW	811	1929	3198	3198	3370	3236
RMW/mean wage for all workers, %	9,7	18,0	27,9	25,1	23,3	24,5
RMW/mean wage for the least skilled workers, %	21,3	38,9	58,7	52,5	48,5	50,3
Fraction at RMW-1 (total wage), %	0,4	1,5	4,7	0,9	2,0	1,0
Number of regions with RMW>FMW for the private sector	9	7	15	25	36	46
Number of regions where higher RMW covers all workers	9	6	12	16	22	27

Table 3. Risks of being at the minimum wage or below by age, gender and education, in percent

	FMW, total wages			FMW, tariff wages			RMW, total wages		
	2005	2009	2015	2005	2009	2015	2005	2009	2015
Gender									
Males	0.2	2.7	0.03	0.9	9.6	5.9	0.2	3.2	1.0
Females	0.3	5.3	0.02	1.3	17.3	11.6	0.3	5.9	0.9
Education									
University	0.1	0.8	0.01	0.3	4.3	3.8	0.1	1.0	0.3
Some university	0.4	4.9	n/a	1.3	15.5	n/a	0.4	5.5	n/a
College	0.3	4.2	0.02	0.9	11.9	12.0	0.3	4.8	1.2
Vocational	0.3	5.5	0.02	1.0	19.0	10.4	0.3	6.2	0.9
Upper secondary	0.5	7.4	0.05	1.9	22.7	13.8	0.5	8.3	1.9
Low secondary and less	0.6	11.9	0.11	2.7	32.7	15.5	0.6	13.1	2.0
Age groups									
Under 19	0.9	8.7	0.04	3.6	25.2	17.1	0.9	10.1	2.8
20-29	0.3	3.4	0.02	1.2	12.4	7.2	0.3	3.9	0.7
30-39	0.3	3.6	0.02	1.0	12.2	7.4	0.3	4.1	0.9
40-49	0.3	4.0	0.03	0.9	13.2	8.3	0.3	4.5	0.9
50-59	0.3	4.4	0.02	1.0	14.9	10.1	0.3	4.8	1.0
60+	0.3	6.7	0.02	2.1	19.6	13.5	0.3	7.9	1.8

Table 3 reports that risks of being at the minimum wage or below vary across population sub-groups. Females are more likely than males to be directly affected by the minimum wage provisions. The likelihood of being paid at the minimum wage is declining with education. The risks of low pay are the highest at the margins of the age distribution. Teenage and elderly

workers take minimum wage jobs more often than workers in other age groups. These results are remarkably the same to what is known for other countries.

Table 4. Risks of being at the minimum wage or below by ownership type and economic activity, in percent

	FMW, total wages			FMW, tariff wages			RMW, total wages		
	2005	2009	2015	2005	2009	2015	2005	2009	2015
Ownership type									
Federal	0.1	2.2	0.02	1.3	10.4	7.0	0.1	2.2	0.02
Regional and municipal	0.4	8.7	0.02	1.4	23.1	16.8	0.4	9.4	1.1
Domestic private	0.4	0.7	0.03	1.1	7.6	3.6	0.4	1.4	1.3
Foreign or joint venture	0.1	0.2	0.00	0.2	2.9	1.1	0.1	0.9	0.9
Domestic mixed (private-public)	0.1	0.5	0.00	0.3	6.0	1.6	0.1	1.0	0.7
Economic activity									
Recreation, arts and sports	0.9	9.9	0.02	2.8	24.3	16.2	0.9	11.1	1.9
Mining and quarrying	0.1	0.3	0.00	0.4	7.2	3.1	0.1	0.4	0.1
Manufacturing	0.2	0.5	0.00	0.5	7.2	2.7	0.2	1.0	0.6
Electricity, gas and steam supply	0.0	0.5	0.00	0.2	7.6	2.5	0.0	0.6	0.3
Construction	0.1	0.5	0.00	0.4	4.9	2.5	0.1	0.9	1.2
Wholesale and retail trade	0.9	1.0	0.02	2.0	7.3	4.7	0.9	1.9	1.3
Hotels and restaurants	0.3	1.2	0.00	1.1	11.3	10.1	0.3	2.8	2.3
Transport and communications	0.1	0.7	0.03	0.4	5.6	2.8	0.1	1.3	1.4
Real estate and business activities	0.3	1.2	0.10	0.9	9.1	6.4	0.3	1.9	0.9
Education	0.5	10.7	0.02	2.5	24.3	15.4	0.5	11.4	1.4
Health	0.1	6.2	0.01	0.7	21.9	19.1	0.1	6.4	0.5

Table 4 reveals that minimum wage workers are disproportionally concentrated in the state and municipal sector. Recreation, arts and sports industry, education and health have the highest fraction of low-paid jobs. In 2009 94% of all workers paid at minimum wage or below were employed at state or municipal establishments. However, we observe remarkable improvement with minimum wage compliance in the public sector during recent years. Enforcement efforts are clearly focused on keeping total wages above the minimum wages – a substantial share of workers have total wage above the federal or regional minimum but tariff wage below this level. Such paying practices are common in the public sector.

Table 5. Earnings inequality: wage differentials and Gini coefficient

Inequality measure	All workers			Females			Males		
	2005	2009	2015	2005	2009	2015	2005	2009	2015
90-10	7.3	6.1	5.7	6.4	5.5	5.2	6.9	5.9	5.6
75-25	2.8	2.6	2.4	2.6	2.5	2.3	2.6	2.5	2.3
90-50	2.5	2.5	2.4	2.5	2.5	2.3	2.4	2.3	2.3
50-10	2.9	2.5	2.4	2.6	2.2	2.3	2.9	2.6	2.5
Gini	0.41	0.39	0.38	0.39	0.38	0.36	0.39	0.38	0.38

To address the question of how much change there has been in earnings inequality from 2005 to 2015, I calculate several measures of wage dispersion that illustrate the changes in different parts of the distribution (Table 5). Inequality is lower than usually reported but we excluded few regions with highest average wages from Tyumen' and Arkhangelsk oblast.

General picture that emerges is that earnings inequality narrowed substantially over the period. For the total wage distribution, the 90-10 wage differential fell from 7.3 to 5.7. The decline was stronger in the lower tail of the wage distribution: the 50-10 wage differential declined from 2.9 to 2.4 while the 90-50 wage differential went down by 0.1 points. The narrowing of the distribution occurred largely between 2005 and 2009. In 2009-2015 improvement slowed down and most indicators do not exhibit any trend.

The earnings inequality among was higher than among females in the beginning of the period, but by the end of the period look very similar apart from longer bottom tail in the male distribution. Both males and females experienced greater contraction of earnings inequality in the bottom of the distribution.

6. Methodology

To understand the role of minimum wage in accounting for the changes in earnings inequality, I use the methodology proposed by Lee (1999) and recently developed in Autor et al (2016). Lee (1999) uses regional variation in the gap between the applicable state or federal minimum wage and median wages to separate the impact of the minimum wage from the growth in underlying ('latent') earnings inequality.

The effect of the minimum wage on earnings inequality depends on how high the minimum wage is set relative to the overall distribution of wages. This level varies across the regions. Unfortunately, the observed wage distribution is a poor guide since it is "distorted" by the minimum wage. Such distortion comes from two effects. First of all, a disemployment effect emerges if the minimum wage exceeds the market-clearing wage. As a result, employers are not willing to hire all of those who want to work at the minimum wage. Those who do not succeed in getting work either stay unemployed or move to the uncovered informal sector. However, by excluding some of the least skilled workers from the market, the minimum wage leads to the compression of the wage distribution. The second effect is related to wages per se. For those not displaced because of the minimum wage changes, an increase in the minimum wage raises the wages of those workers who were initially making less than the minimum wage to exactly the level of the new wage floor. These workers are directly affected by the minimum wage. A larger

group is likely to be affected indirectly[9]. It contains those who were originally paid above the minimum wage and whose wages were increased to preserve the relative-wage ratios and maintain the incentives structure. Such "spillover" effect diminishes the higher the wage percentile. Both direct wage effects and spillovers lead to narrowing of the wage distribution. Note that the methodology used by Lee (1999) and Autor et al (2016) ignores potential disemployment effects of changes in the real minimum wage and focuses on direct wage and spillover effects. They argue that disemployment effects are trivial, but admit that if there were substantial disemployment effects, they could lead to upward bias in the estimation of spill-over effects.

The main idea is to construct the latent wage distribution, i.e. the distribution of wages that would prevail in the absence of any minimum wage. Lee (1999) speculates that the shape of such distribution depends on the gap between the log of the minimum wage and the log regional median $m_{reg} = w_{reg}^{m} - w_{reg}(50)$ which is referred to as the "effective minimum wage". The minimum wage can have an effect on *p*-th percentile of the actual wage distribution and this effect is a function of the effective minimum wage: $w_{reg}(p) - w_{reg}(50) = \mathrm{g}(w_{reg}^{m} - w_{reg}(50))$. Such functions can be estimated for each percentile of the distribution with the region-level data using the following equation (*t* subscripts are dropped for the sake of clarity):

$$w_{reg}(p) - w_{reg}(50) = \left(w_{reg}^{*}(p) - w_{reg}^{*}(50)\right) + \beta_1 m_{reg} + \beta_2 m_{reg}^{2} + YearDummies + \varepsilon_{reg}, \quad (1)$$

where $w_{reg}^{*}(p)$ denotes the latent values of percentile p in each region, β_1 and β_2 are allowed to vary by percentile. Regressions are estimated on the region-year data aggregated from the original dataset.

Quadratic term is motivated by the idea that a change in the minimum wage has more impact on the distribution if it is more binding. The percentiles of the latent distribution are unobserved; they enter as a constant into the equation (1). Thus, estimation is based on the assumption that each percentile of the latent distribution $\left(w_{reg}^{*}(p) - w_{reg}^{*}(50)\right)$ is constant across regions. In other words, the shape of the latent wage distribution in year *t* is believed to be the same for all regions, though the median can be different. This assumption can be weakened by including relevant regional controls such as unemployment rate. The error term is assumed to be independent of region and year effects.

Autor et al. (2016) consider other possible sources of misspecification in OLS estimates. The major problem comes from Lee's identifying assumption that the shape of the latent wage

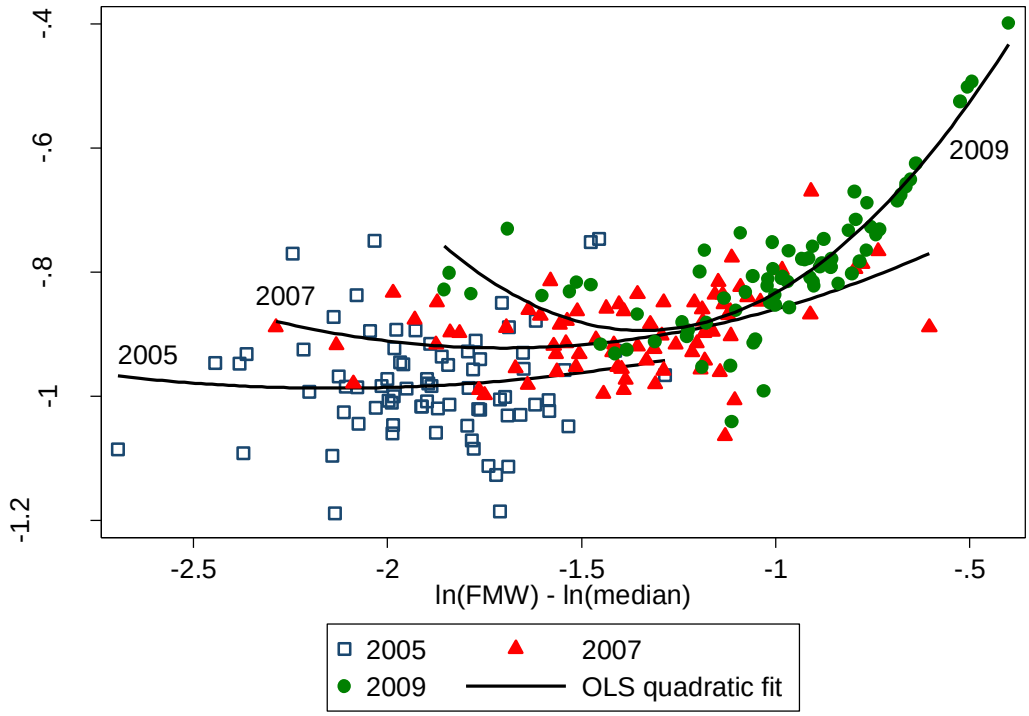
[9] See Grossman (1983) for the relative wages explanation of spillover effects and Teuling (2000, 2003) for an explanation based on imperfect substitution between workers with different skills.

distribution in year *t* is constant across regions. This assumption implies that regional latent earnings inequality is uncorrelated with the median. If this assumption is violated, regional fixed effects should be included into equation (1).

The second source of misspecification is the division bias that stems from the inclusion of the regional median wage variable in both the dependent and independent variables. It may cause an upward simultaneity bias in the estimates, since the regional median enters with the same sign on both sides of the equation. Following Autor et al. (2016), we remove this bias by instrumenting the effective minimum wage with the log the statutory minimum wage, its square and its interaction with the average log median real wage for the region over the sample period.

I estimate equation (1) and its extensions on the panel of 77 Russian regions. This panel was constructed using micro-data from the Survey of Occupational Wages described in Sections 3 and 4. The effects are estimated for the entire sample and for sub-samples of males and females.

Fig. 5 plots the relationship between the 10-50 log-wage differential and the effective minimum wage in our data. The solid lines represent the fitted values of OLS quadratic regressions with no other controls, one for each year. This figure also shows that the relationship is not linear but, in general, consists of two segments. The first segment is flat, suggesting no relationship between the differential and the relative minimum wage. It is the area where effective regional minima are smaller than the differential and thus have no effect on its value. The second segment lies along the 45-degree line. It presents the regions for which the minimum wage is binding at the 10^{th} percentile and the differential is exactly equal to the effective minimum. This shape explains the use of quadratic functional form in Equation (1). In Russia the relationship between the 10-50 log-wage differential and effective minimum wage was almost flat in 2005, 2007, 2013 and 2015, but is strong in 2009 and 2011, reflecting the fact that the ”bindingness” of the minimum wage reached its peak in the latter years. Moreover, the fitted line for 2007 is above the that for 2005, the line for 2009 lies even higher, implying an upward shift in the relationship over the period and decrease in latent inequality. At the same time there is no clear vertical shift between 2011 and 2015.



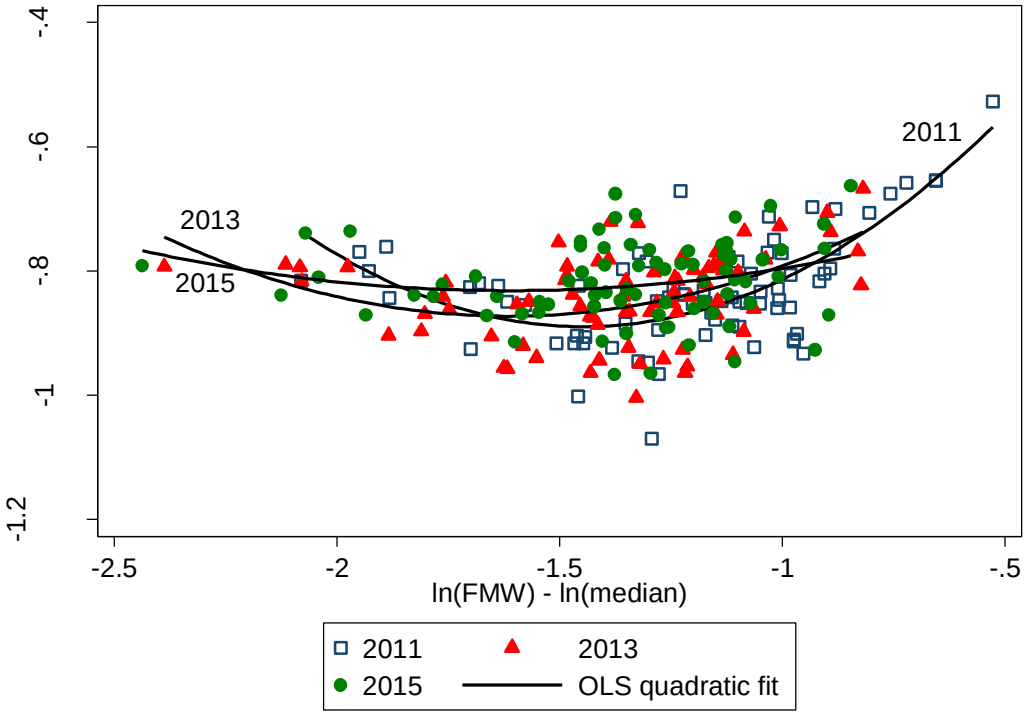


Fig. 5. 10-50 log-wage differential vs relative minimum wage

I estimate three different specifications for the effective minimum based on the federal minimum wage: $m_{reg} = ln(FMW) - w_{reg}(50)$. Movements of the federal minimum wages are the same for all regions (except the period between 2005 and 2007 when the use of the northern coefficients was cancelled, and the rise of minimum wage was substantially lower for the regions that applied

the northern coefficients in 2005) but variation comes from the differences in regional medians. Each specification is estimated with OLS and 2SLS. The first specification includes the effective minimum, its square, and time effects. To control for the probable effects of the global economic crisis, which led to a reduction in working hours, growth of unemployment, and significant expansion of ALMPs, I include three additional variables into the second specification: average hours worked (H_{reg}), unemployment rate (U_{reg}) and the share of state and municipal sector in total employment ($State_{reg}$). Data on regional unemployment rates are taken from the Russian labour force survey, while the other two variables were calculated from the underlying survey by aggregating the data at the regional level. The third specification does not include region-level controls but instead contains time-invariant region effects and region-specific trends. Regional fixed effects and trends are likely to control for most economic fluctuations at the regional level.

Next we re-estimate all specifications for the effective minimum calculated on the basis of regional minimum wages: $m_{reg} = ln(RMW) - w_{reg}(50)$.

7. Estimating the impact of the minimum wage on wage differentials

The predicted effect of a unit change in the effective minimum wage on the difference between the p^{th} percentile and the median is given by a marginal effect: $\hat{\beta}_1(p) + 2\hat{\beta}_2(p)m_{reg}$, where $\hat{\beta}_1(p)$ and $\hat{\beta}_2(p)$ are estimated coefficients in Equation (1). To choose the preferred strategy for estimation I compare different specifications for two definitions of the effective minimum wage. Table 5 reports the estimated marginal effects for the effective minimum based on the federal minimum wage: $ln(FMW) - ln(p50)$ for the pooled sample. Table 6 provides the estimates for the definition based on regional minimum wages: $ln(RMW) - ln(p50)$. Regression are estimated with region-year data constructed from original dataset. Marginal effects were estimated at the weighted average of the relevant effective minimum wage across regions and years. The weights are the sums of individual sampling weights for each year-region.

These marginal effects produce a good specification test. First, we expect that the effect of minimum wages, if significant, is positive for the bottom of the distribution. Significantly negative marginal effects imply that an increase in the minimum wage leads to widening of lower half of the wage distribution, which is clearly counterintuitive. Second, we can be reasonably confident that the effects of the minimum wage are limited to the lower tail of the distribution and the minimum wage has no effects on the upper tail of distribution. Taken at face value, these results would indicate a systematic relationship between the effective minimum and upper percentiles of the distributions. This implies that a *decline* in the effective minimum wage leads to wage *compression at the top* of the distribution. Therefore, specifications that give

significantly negative marginal effects for the bottom part of the distribution or significant marginal effects of any sign for the top-tail wage differentials are suspected of misspecification.

Table 5. Marginal effects for selected percentiles of the pooled distribution: Effective minimum based on the federal minimum wage $ln(FMW) - ln(p50)$

	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)
p(5)	0.146**	0.401	0.133**	-0.212	0.281**	0.352*
	(0.013)	(0.976)	(0.016)	(1.319)	(0.081)	(0.178)
p(10)	0.076**	0.303	0.086**	-0.304	0.158**	0.300*
	(0.009)	(0.868)	(0.011)	(1.468)	(0.055)	(0.122)
p(20)	0.024**	0.161	0.043**	-0.264	0.067*	0.225**
	(0.006)	(0.523)	(0.007)	(1.148)	(0.032)	(0.072)
p(30)	0.008*	0.100	0.023*	-0.191	0.045*	0.160**
	(0.004)	(0.352)	(0.005)	(0.798)	(0.020)	(0.046)
p(40)	0.003	0.048	0.012**	-0.083	0.012	0.073**
	(0.002)	(0.174)	(0.002)	(0.354)	(0.011)	(0.024)
p(75)	-0.024**	-0.099	-0.051**	0.101	-0.047**	-0.048
	(0.005)	(0.296)	(0.005)	(0.571)	(0.018)	(0.038)
p(90)	-0.095**	-0.305	-0.135**	0.077	0.004	-0.044
	(0.009)	(0.795)	(0.010)	(0.821)	(0.029)	(0.063)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	No	Yes	Yes
Regional trends	No	No	No	No	Yes	Yes
Regional controls	No	No	Yes	Yes	No	No

Note: N = 462. Sample period is 2005-2015. The dependent variable is $ln(p) - ln(p50)$ where *p* is the indicated percentile. Estimated at the weighted average of effective minimum wage across regions and years. Observations at the region-year level. Regressions are weighted by the sum of individual sampling weights. For 2SLS specifications, the instruments are the log of the real minimum wage, its square, and its interaction with the average log median real wage for each region over the sample period. Regional controls include average hours worked, unemployment rate and the share of public employment in total employment. Standard errors are in parentheses. *p-value <0.05, ** - p-value<0.1.

We start with comparing the OLS estimates between specifications. These comparisons suggest that inclusion of regional fixed effects and region-specific trends is essential. There is a significant and strong negative relationship between the effective minimum wage and upper tail inequality for both definitions of effective minimum and all three samples (see the results for male and female samples in Table 7). There must be some bias in these estimates.

Inclusion of the regional fixed effects and region-specific trends does not solve the problem entirely, but it produces fewer significantly negative estimates for upper percentiles and these estimates are smaller in magnitude. Autor et al. (2016) explains that the bias comes from the correlation between the regional median and the latent regional wage inequality. A downward bias in the upper tail emerges because high-wage regions have large gap between the minimum

wage and the median and consequently more negative effective minimum wages (which is specifically true if the federal minimum is used in calculations). If these regions also have greater latent wage inequality in the upper half of the distribution, then the estimates will be downward biased for the percentiles above the median. Differences in the lower-tail latent inequality between high- and low-wage regions can lead to biases in the lower tail as well. If high wage regions tend to have greater latent wage dispersion at the bottom of distribution, then exclusion of regional effects will result in upward-biased estimates for the lower percentiles. Inclusion of regional fixed effects allows us to control for inter-regional differences in latent earnings distributions. Additionally, region-specific linear time trends are included to control for local conditions. In columns 3 and 4, I experimented with including other regional controls (average hours worked, unemployment rate and the share of public employment in total employment) instead of regional fixed effects and regional trends. These regional controls seem to be poor proxies for local economic situation and exaggerate the biases. These specifications are not presented in Table 7 for male and female distributions, but results were qualitatively similar.

Table 6. Marginal effects for selected percentiles of the pooled distribution: Effective minimum based on the regional minimum wage $ln(RMW) - ln(p50)$

	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
p(5)	0.212**	0.402**	0.188**	0.358**	0.126**	0.072*
	(0.017)	(0.103)	(0.019)	(0.089)	(0.039)	(0.036)
p(10)	0.117**	0.211**	0.123**	0.248**	0.091**	0.071**
	(0.012)	(0.057)	(0.014)	(0.065)	(0.027)	(0.024)
p(20)	0.042**	0.095**	0.058**	0.152**	0.062**	0.060**
	(0.008)	(0.035)	(0.009)	(0.048)	(0.015)	(0.014)
p(30)	0.015**	0.066*	0.028**	0.109**	0.038**	0.036**
	(0.005)	(0.029)	(0.006)	(0.040)	(0.010)	(0.009)
p(40)	0.003	0.036*	0.011**	0.062*	0.009	0.008
	(0.003)	(0.018)	(0.003)	(0.025)	(0.005)	(0.005)
p(75)	-0.023**	-0.160*	-0.040**	-0.230**	-0.020*	-0.009
	(0.007)	(0.070)	(0.007)	(0.088)	(0.009)	(0.008)
p(90)	-0.074**	-0.495*	-0.083**	-0.579**	0.013	0.019
	(0.014)	(0.205)	(0.015)	(0.224)	(0.014)	(0.013)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	No	Yes	Yes
Regional trends	No	No	No	No	Yes	Yes
Regional controls	No	No	Yes	Yes	No	No

Note: See text at the bottom of Table 5. *p-value <0.05, ** - p-value<0.1.

There is no evidence of upward biases for low percentiles in Table 5 (compare columns 1 and 5): specification with regional effects gives higher estimates and has higher standard errors. Such upward biases are clearly seen in Table 6 and Table 7. The reason is that correlation between the regional median and the latent inequality is not the only source of econometric problems in Equation (1). The use of the federal minimum wage does not provide enough regional variation to estimate the effect. The estimation relies largely on time-variation, variation across regions is limited to 2005. Even for 2005 variation in federal minimum is not precisely estimated as I employ the lowest value of the northern coefficients applicable in the region and ignore intra-region variation in the northern coefficients. Insufficient variation results in low precession of estimates of OLS estimates in column 5 and of all 2SLS estimates in Table 5. The use of regional minimum wages improves identification providing additional source of variation due to differences in the value of regional minimum wages.

Table 7 Marginal effects for selected percentiles of the male and female distributions: Effective minimum based on the regional minimum wage $ln(RMW) - ln(p50)$

	Males				Females			
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
p(5)	0.172**	0.255**	0.106**	0.082*	0.245**	0.415**	0.144**	0.087*
	(0.020)	(0.069)	(0.037)	(0.034)	(0.017)	(0.077)	(0.041)	(0.038)
p(10)	0.097**	0.212**	0.103**	0.092**	0.137**	0.223**	0.110**	0.082**
	(0.018)	(0.076)	(0.027)	(0.025)	(0.012)	(0.047)	(0.029)	(0.026)
p(20)	0.034**	0.129*	0.067**	0.053**	0.049**	0.082**	0.065**	0.049**
	(0.012)	(0.061)	(0.018)	(0.016)	(0.008)	(0.026)	(0.017)	(0.016)
p(30)	0.006	0.063	0.025*	0.018**	0.021**	0.048**	0.042**	0.035**
	(0.007)	(0.037)	(0.010)	(0.009)	(0.005)	(0.018)	(0.011)	(0.010)
p(40)	0.002	0.027	0.006	0.000	0.006*	0.021*	0.016**	0.016**
	(0.004)	(0.017)	(0.005)	(0.005)	(0.003)	(0.010)	(0.006)	(0.005)
p(75)	-0.019*	-0.069	-0.025*	-0.005	-0.034**	-0.195**	0.010	0.016
	(0.009)	(0.040)	(0.010)	(0.009)	(0.007)	(0.060)	(0.010)	(0.009)
p(90)	-0.059**	-0.149*	0.008	0.017	-0.098**	-0.484**	-0.004	0.000
	(0.018)	(0.071)	(0.015)	(0.014)	(0.013)	(0.142)	(0.017)	(0.016)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	Yes	Yes	No	No	Yes	Yes
Regional trends	No	No	Yes	Yes	No	No	Yes	Yes
Regional controls	No	No	No	No	No	No	No	No

Note: See text at the bottom of Table 5. * - p-value <0.05, ** - p-value<0.1.

According to Autor et al., the major potential specification problem stems from the division bias as the median enters both the left- and the right-hand side of Equation (1). This may generate a

correlation between transitory error components on both sides of the equation. This problem is likely to drive up the estimates of the effective minimum wage coefficient in both lower and upper halves of the distribution[10]. As in Autor et al. (2016) I deal with this problem by instrumenting the effective minimum wage with the log of the real minimum wage, its square, and its interaction with the average log median real wage for each region over the sample. Thus our preferred estimation strategy employs the regional minimum wage and relies on IV approach – see column 6 in Table 6 for the polled sample and columns 4 and 8 in Table 7 for male and female samples, respectively.

For the lower tail of the distribution, all these specifications agree in showing the positive effect of minimum wages, which diminishes while moving along the wage distribution. Surprisingly, the results suggest that the effects of minimum wages increases are similar for males and females in the lowest percentiles. The only difference is the minimum wages effects persist up through the 40th percentile for females and up through the 30th percentile for males. In the pooled distribution, significant effects are observed up through the 30th percentile. This happens because females with lower wages prevail in the lower part of the pooled distribution.

8. Estimating the counterfactual change in inequality

How much of the compression of earnings inequality in 2005-2015 was due to the minimum wage hikes? Following Lee (1999) and Autor et al. (2010), I present counterfactual estimates of the change in latent earnings inequality absent the increase in the minimum wage—that is, the change in earnings inequality that would have been observed had the real minimum wage been held at the 2005 level. These counterfactuals are constructed using the OLS and 2SLS specifications for effective minimum based regional minimum wage which include regional fixed effects and regional trends.

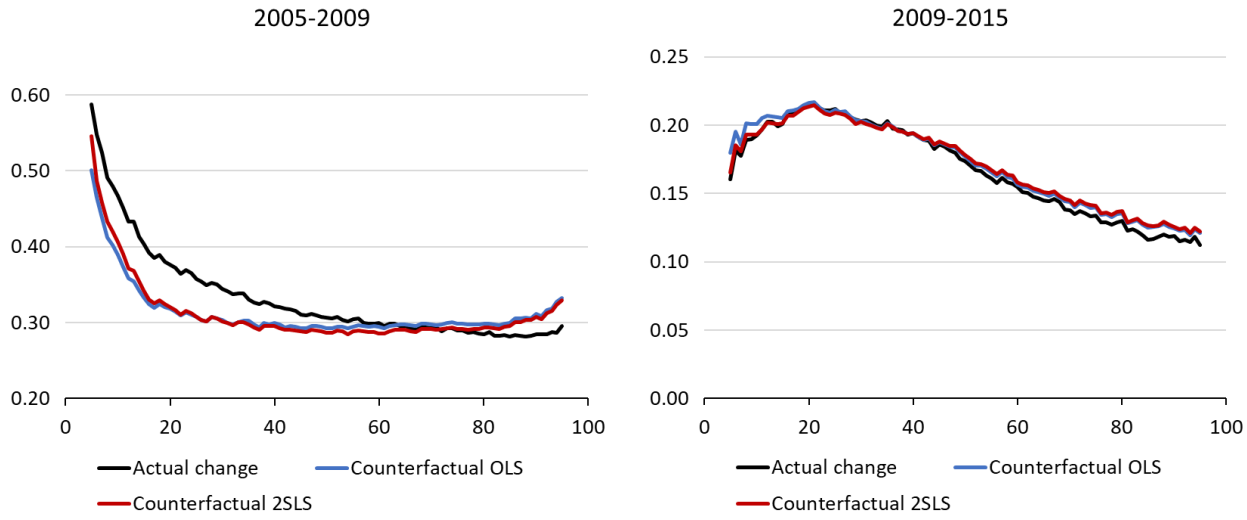
To estimate changes in latent earnings inequality, for each individual in the dataset, I calculate her percentile position in the regional wage distribution for the final year of the period (2009 or 2015). Then, I adjust each wage by the magnitude:

$$\Delta w_{reg}^{p} = \hat{\beta}_1^p\left(\widetilde{m}_{reg,\tau 0} - \widetilde{m}_{reg,\tau 1}\right) + \hat{\beta}_2^p\left(\widetilde{m}_{reg,\tau 0}^2 - \widetilde{m}_{reg,\tau 1}^2\right) \quad (2)$$

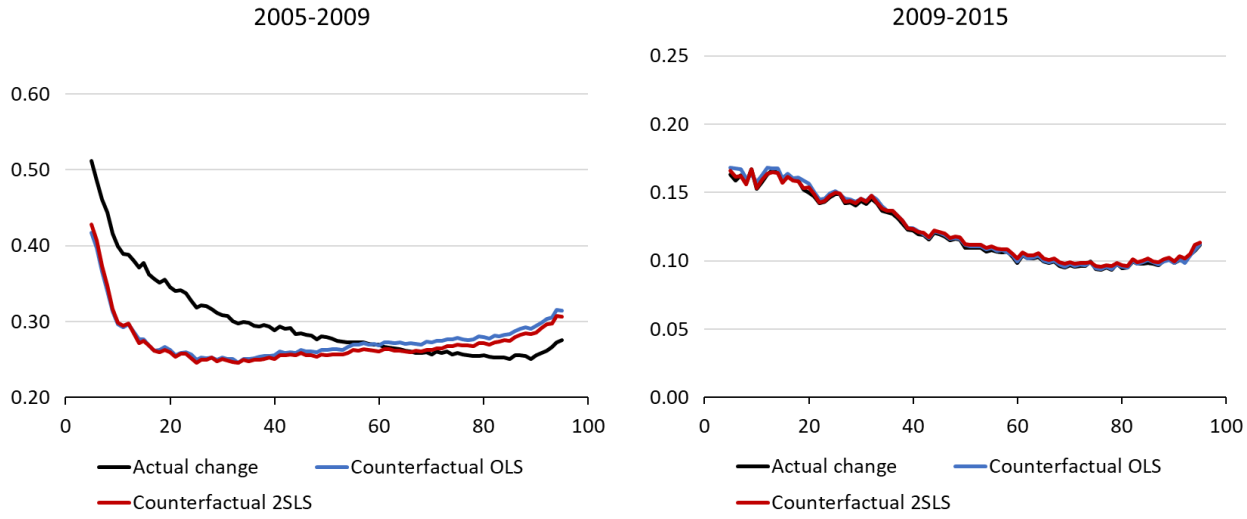
Where $\tau 0$ is the initial year of the period, $\tau 1$ is the final year of the period, $\widetilde{m}_{reg,\tau 1}$ is the observed effective minimum in region *reg* in period $\tau 1$, $\widetilde{m}_{reg,\tau 0}$ is the corresponding effective minimum in period $\tau 0$, and $\hat{\beta}_1^p$ and $\hat{\beta}_2^p$ are point estimates of the coefficients of effective minimum and its square from Equation (1).

[10] Autor et al. (2016) points that an upward bias in the lower tail may be also caused by measurement errors if minimum wage workers are inaccurate in reporting their wages. However, measurement error is not likely to be of particular concern in this paper as data come from an establishment survey.

A. Pooled sample



B. Males



C. Females

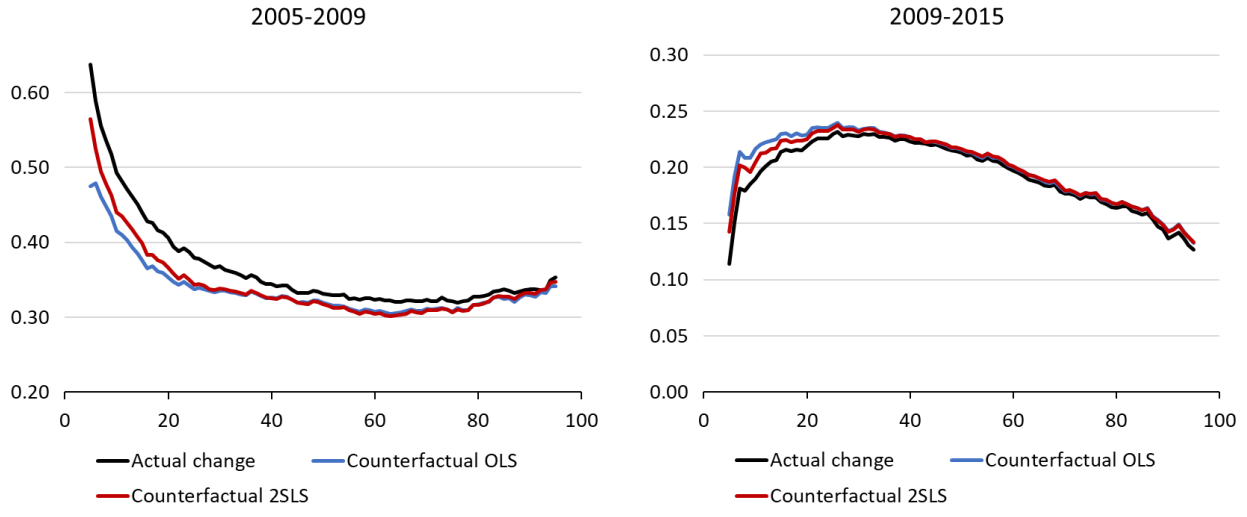


Fig. 7. Difference between counterfactual and actual changes in log-earnings by percentiles of the distribution

Equation (2) is applied to all percentiles between 1 and 99. Estimates for each sample (pooled, males, and females) employ the coefficients calculated specifically for this sample. To account for large minimum wage increases in 2007 and 2009, I consider two sub-periods 2005-2009 and 2009-2015.

Fig. 6 provides a visual comparison between observed and counterfactual changes in log-earnings in 2005-2009 and 2009-2015 across the percentiles of the distribution. It reveals that the difference in predicted changes between OLS and 2SLS-based counterfactuals is small for all samples especially for 2009-2015. Unexpectedly there are large positive differences between counterfactual and actual changes in earnings for upper tail of the pooled and particularly in the male distribution in 2005-2009 suggesting sizeable negative effects of the minimum wage on the upper half of the distribution as if potential earnings increases of high-wage workers were redistributed in favour of low-wage workers. There is no evidence of such bias in 2009-2015.

For all samples, the bulk of the effect is concentrated in the lowest quintile, especially in the bottom decile. In 2005-2009, the impact of the minimum wage seems stronger for males which a strange finding because the minimum wage is more binding for females (see Table 3). At the same time the impact of minimum wages is virtually absent for males in 2009-2015 but can be clearly seen in the female distribution.

In all distributions the minimum wage had substantial spill-over effects on percentiles above where it binds, especially for the earlier period. Existence of high spillover effects in Russia may be a consequence of specific wage-setting framework in the budgetary sector that was still in place in most Russian regions on 2005-2009. Within this framework, the basic tariff part of the budgetary sector wage was defined on the basis of the Unified Tariff Scale (UTS) (Gimpelson and Lukiyanova, 2009). The first grade of the UTS was directly linked to the level of the statutory minimum wage. Therefore, any increase in the minimum wage would trigger an increase in the tariff component of wages throughout the whole budgetary sector distribution. The coefficients of the UTS could even amplify the effect of such an increase for the higher deciles of the distribution. The UTS was abandoned for the federal employees in December 2008 and was replaced with the New Pay System (NPS). According to this new system, wages were determined by regional and sectoral collective agreements that fixed the basic salary for each occupational and skill group, while establishment-level regulations introduced additional compensation and incentive payments. Each budgetary subsector (education, health, science and culture) was supposed to get its own pay system with no reference to the former UTS. Regional governments were allowed to design their own pay systems for employees in their jurisdictions. Public sector administrators gained more flexibility in determining schedules and amounts of

individual incentive payments. The implementation of the reform went slowly; at regional level transition was accomplished by the end of 2012 only.

Another reform of the public sector way began in May, 2012 with the adoption of the Presidential Decrees on earnings in the budgetary sector. These decrees were aimed to increase earnings in selected – mostly, high-skilled – occupations (doctors, nurses, school teachers, university faculty, etc.) in the public sector. For these groups of workers, the Decrees set stringent pay targets tied to average earnings in the region. Earnings of low-skilled occupations not listed in the Decrees were out of mandatory targets. Such policy explains the inverse-U shape of the graph for female earnings in 2009-2015. Earnings between 20th percentile and the median grew faster than earnings in other parts of the distribution. An increase of the minimum wage to its 2009 level would have allowed to reach a comparable wage growth in lower percentiles.

Table 8. Changes in the 50-10 log earnings differential

Year	Log differential	Actual change	Counterfactual change	
			OLS	2SLS
A. Pooled sample				
2005	1.057			
2009	0.897	-0.160	-0.097	-0.119
2015	0.878	-0.019	-0.024	-0.015
B. Males				
2005	1.065			
2009	0.946	-0.120	-0.033	-0.043
2015	0.903	-0.043	-0.046	-0.041
C. Females				
2005	0.965			
2009	0.804	-0.161	-0.095	-0.123
2015	0.828	0.023	-0.001	0.012

Because the minimum wage policy particularly aims to help low-earning workers, it is important to assess in how the minimum wage policy affects inequality at the bottom half of the earnings distribution. Table 8 reports changes in the 50-10 log earnings differential. The actual value of the 50-10 log earning differential for the pooled sample was 1.057 in 2005, 0.897 in 2009 and 0.878 in 2015. Hence, the actual change was −0.160 log points between 2005 and 2009, and −0.019 log points between 2009 and 2015. Inequality declined sharply in the first sub-period and was roughly stable over the second period. Had there been no changes in the minimum wage between in 2005-2009 and 2009-2015, what would the p50-p10 earnings gap be in the final years of each sub-period? The OLS specification that had the minimum wage been constant at its real 2005 level, the 50-10 inequality would counterfactually have risen by −0.097 log points in 2009.

The 2SLS specification produces an estimate of −0.119 counterfactual rise. Thus, the minimum wage can explain 25-40% of the observed fall in the inequality at the bottom of the distribution in 2005-2009.

The results are less clear-cut for the second sub-period. The 2SLS specification suggests that minimum wage can account for just 0.004 log points (of 0.019) fall in the inequality. The OLS specification predicts that inequality would have been *lower* by 0.005 log points in 2015 had the real minimum wage remained at the 2009 level. However, both numbers are very small, and it is unlikely that the minimum wage had any substantial effect on inequality in 2009-2015.

Most of the reduction in overall earnings inequality in 2005-2009 happened because of substantial narrowing of the female distribution. However, the effect of minimum wages was stronger for males. Panels B and C of Table 8 show that the additional decline in the 50-10 log-wage differential, caused by the increase in the real minimum wage in 2005-2009, is equal to 0.077−0.086 log points for males and to 0.037−0.065 log points for males. It amounts to 65-70% of the overall decline in 50-10 earnings inequality for males and 25-40% - for females. These effects are large for both male and females, and they confirm that the rising minimum wage contributed meaningfully to falling lower-tail inequality over 2005-2009.

For 2009-2015 the contribution of the minimum wage to inequality is negligible for males. For females, the minimum wage retains some significance – bottom tail inequality would have been 0.012−0.024 log points lower had the minimum wage remained at the 2009 level.

9. Concluding remarks

This paper investigates the impact of the minimum wage increases on the wage distribution between 2005 and 2015 by using payroll data on wages in the Russian corporate sector. I estimate that a sharp increase in the real value of the minimum wage has strong inequality-reducing effect in 2005-2009. At the same time slow decline of the minimum wage in 2009-2015 had negligible effect on inequality. For 2005-2009, the minimum wage is "responsible" for 25-40% of the compression of lower tail inequality in the overall earnings distribution as measured by the log-wage differential between the 50^{th} and 10^{th} percentile.

Since a relatively small fraction of workers is directly affected by the minimum wage regulation in modern Russia (i.e., they receive wages at or below the minimum wage), my estimates suggest that spillover effects account for a significant part of the overall impact. One explanation of these spillovers is related to pay structures that prevailed in the Russia's state sector through the late 2000s. The minimum wage was linked to the lowest grade of the Unified Tariff Scale and its increase generated the rise of all wages in the budgetary via the system of tariff coefficients. Additionally, sizable spillover effects can be explained by improved enforcement at least in the

corporate sector. In the late 2000s, the State Tax Service got broad powers to monitor wages, detect low-paying firms and force them to increase wages.

The findings in this paper have a few implications for future research on earnings inequality. First, while the minimum wage was certainly an important contributing factor to narrowing of lower tail inequality, especially for females, it was not the only one. The rapid growth of wages at the bottom of the distribution started in 2001 when minimum wages remained symbolic. Between 2005 and 2009, about 60-75% of the reduction in overall lower tail inequality cannot be attributed to minimum wages and still needs to be explained. Second, because of data limitations I did not consider wages in the informal sector and at small firms where low-wage private sector workers are concentrated. Third, the paper overlooks disemployment effects and the possibility of crowding out workers to the informal sector. I believe that for the period under consideration these effects were small, but this should be proved with more scrutiny. The lack of evidence on employment effects of minimum wages in Russia limits the scope of policy implications. It has been shown that the minimum wage compresses inequality. However, greater knowledge of its impact on employment is needed to estimate the total welfare effects and advocate minimum wages as a poverty alleviation tool.

References

Amadeo, E., and J.Camargo (1997). Brazil: Regulation and Flexibility in the Labour Market, In: Edwards, S., Lustig, N.C. (Eds.), ***Labour Markets in Latin America***, Brookings Institution Press, Washington.

Autor, D., Manning, A. and C. Smith (2016). The Contribution of the Minimum Wage to the U.S. Wage Inequality over Three Decades: A Reassessment, *American Economic Journal: Applied Economics*, Vol. 8(1): 58-99.

Berger, M., Blomquista, G. and K. Sabirianova Peter (2008). Compensating Differentials in Emerging Labor and Housing Markets: Estimates of Quality of Life in Russian Cities, *Journal of Urban Economics*, Vol. 63(1): 25-55.

Brainerd, E. (1998). Winners and Losers in Russia's Economic Transition, *American Economic Review*, Vol. 88(5): 1094-1116.

Calvo, P., Lopez-Calvo, L., Posadas, J. (2015). A Decade of Declining Earnings Inequality in the Russian Federation. Policy Research Working Paper 7392. Washington, D.C.: World Bank Group.

Ferraro, S., Meriküll, J., Staehr, K. (2018). Minimum Wages and the Wage Distribution in Estonia, *Applied Economics*, Vol. 50(49): 5253-5268.

Flemming, J. and J.Micklewright (1999). Income Distribution, Economic Systems and Transition. In: Atkinson, A., Bourguignon, F. (Eds.) ***Handbook of Income Distribution***, Elsevier Science BV.

Ganguli, I. and K.Terrell (2006). Institutions, Markets and Men's and Women's Wage Inequality: Evidence from Ukraine, *Journal of Comparative Economics*, Vol. 34: 200-227.

Gimpelson, V. and R.Kapeliushnikov (2011). Labor Market Adjustment: Is Russia Different?, Working Paper WP3/2011/04, Higher School of Economics, Moscow.

Gimpelson V. and A.Lukiyanova (2009). Are Public Sector Workers Underpaid in Russia? Estimating the Public-Private Wage Gap", IZA Discussion Paper No.3941, January.

Gindling, T. and K.Terrell (1995). The Nature of Minimum Wages and Their Effectiveness as a Wage Floor in Costa Rica, 1976-91, *World Development*, Vol. 23: 1439–1458.

Grossman, J. (1983). The Impact of the Minimum Wage on Other Wages, Journal of Human Resources, Vol. 18(3): 359-378.

Kapelyuk, S. (2015). The effect of minimum wage on poverty: Evidence from RLMS-HSE data. *Economics of Transition* 23, 2: 389-423.

Kertesi, G. and J.Köllő (2003). Fighting "Low Equilibria" by Doubling the Minimum Wage? Hungary's Experiment, IZA Discussion Paper No. 970, December.

Kecmanovic, M. (2012). Men's wage inequality in Serbia's transition, *Economic Systems*, Vol.36(1): 65-86.

Lee, D. (1999). Wage Inequality in the United States during the 1980s: Rising Dispersion or Falling Minimum Wage? *Quarterly Journal of Economics*, Vol. 114: 977-1023.

Lehmann, H., Wadsworth, J. (2007). Wage Arrears and Inequality in the Distribution of Pay: Lessons from Russia/ Research in Labor Economics, Vol. 26: 125-155.

Lemos, S. (2009). Minimum Wages in a Developing Country, *Labour Economics*, Vol.16: 224-237.

Lin, C., Yun, M.-S. (2016). The Effects of the Minimum Wage on Earnings Inequality: Evidence from China, Research in Labor Economics, Vol. 44: 179-212.

Lukiyanova, A. (2016). Regional Variation in the Minimum Wage Policies in the Russian Federation (2007-2015), *Public Administration Issues*, 2016(1): 81-102.

Maloney, W. and J.Mendez (2004). Minimum wages in Latin America. In: Heckman, J., Pagés, C. (Eds.) ***Law and Employment: Lessons from Latin America and the Caribbean***, NBER and University of Chicago, Cambridge, MA.

Muravyev, A., Oshchepkov, A. (2013). Minimum wages, unemployment and informality: evidence from panel data on Russian regions. IZA Discussion Paper 7878.

Muravyev, A., Oshchepkov, A. (2016). The effect of doubling the minimum wage on employment: evidence from Russia. *IZA Journal of Labor & Development* 5:6.

Neumark, D. and W.Wascher (2007). Minimum Wages and Employment, IZA Discussion Paper No.2570.

Teulings, C. (2000). Aggregation Bias in Elasticities of Substitution and the Minimum Wage Paradox, *International Economic Review*, Vol.41: 359–398.

Teulings, C. (2003). The Contribution of Minimum Wages to Increasing Inequality, *Economic Journal*, Vol.113: 801-833.

Appendix

Table A1. Description of the sample

	2005	2007	2009	2011	2013	2015
Average age, years	43.0	43.3	43.8	43.6	44.0	44.1
Average hours worked in October	169.2	180.3	173.5	168.4	179.8	174.6
Fraction of females, %	55.6	55.9	56.6	55.3	54.8	55.1
Education, %						
University	28.0	30.5	33.7	35.2	37.2	39.4
Some university	2.5	2.8	3.5	2.9		
College	28.7	28.4	27.5	27.5	23.4	26.2
Vocational	11.1	11.6	11.9	11.8	15.6	13.4
Secondary	23.8	21.6	19.6	19.2	22.8	20.3
Low secondary and less	5.9	5.1	3.9	3.5	0.9	0.7
Ownership type, %						
State	19.2	17.5	17.8	17.3	14.4	13.5
Municipal	38.4	37.7	40.7	38.9	39.9	40.3
Domestic private	26.6	30.4	28.0	29.5	30.5	31.2
Foreign or joint venture	5.6	6.2	7.0	7.7	8.9	8.8
Domestic mixed (private-public)	10.3	8.2	6.5	6.8	6.4	6.2
Economic activity, %						
Recreation, arts and sporting activities	3.5	3.5	3.7	3.7	3.5	3.5
Mining and quarrying	2.4	2.3	2.2	2.3	2.3	2.3
Manufacturing	22.0	20.7	18.6	19.4	18.8	18.4
Electricity, gas and steam supply	6.0	5.7	6.1	6.1	6.0	6.1
Construction	4.1	4.4	4.2	4.4	4.3	3.8
Wholesale and retail trade	5.7	7.1	6.7	7.0	8.3	8.3
Hotels and restaurants	1.0	1.1	0.9	0.9	0.9	0.9
Transport and communications	10.6	10.2	10.2	10.1	9.9	9.7
Real estate, renting and business activities	10.1	10.0	9.3	8.9	9.2	10.0
Education	20.8	21.4	23.0	22.3	22.0	21.9
Health	13.8	13.9	15.1	14.9	15.0	15.1
Number of observations	650801	726564	692059	702775	693606	755463

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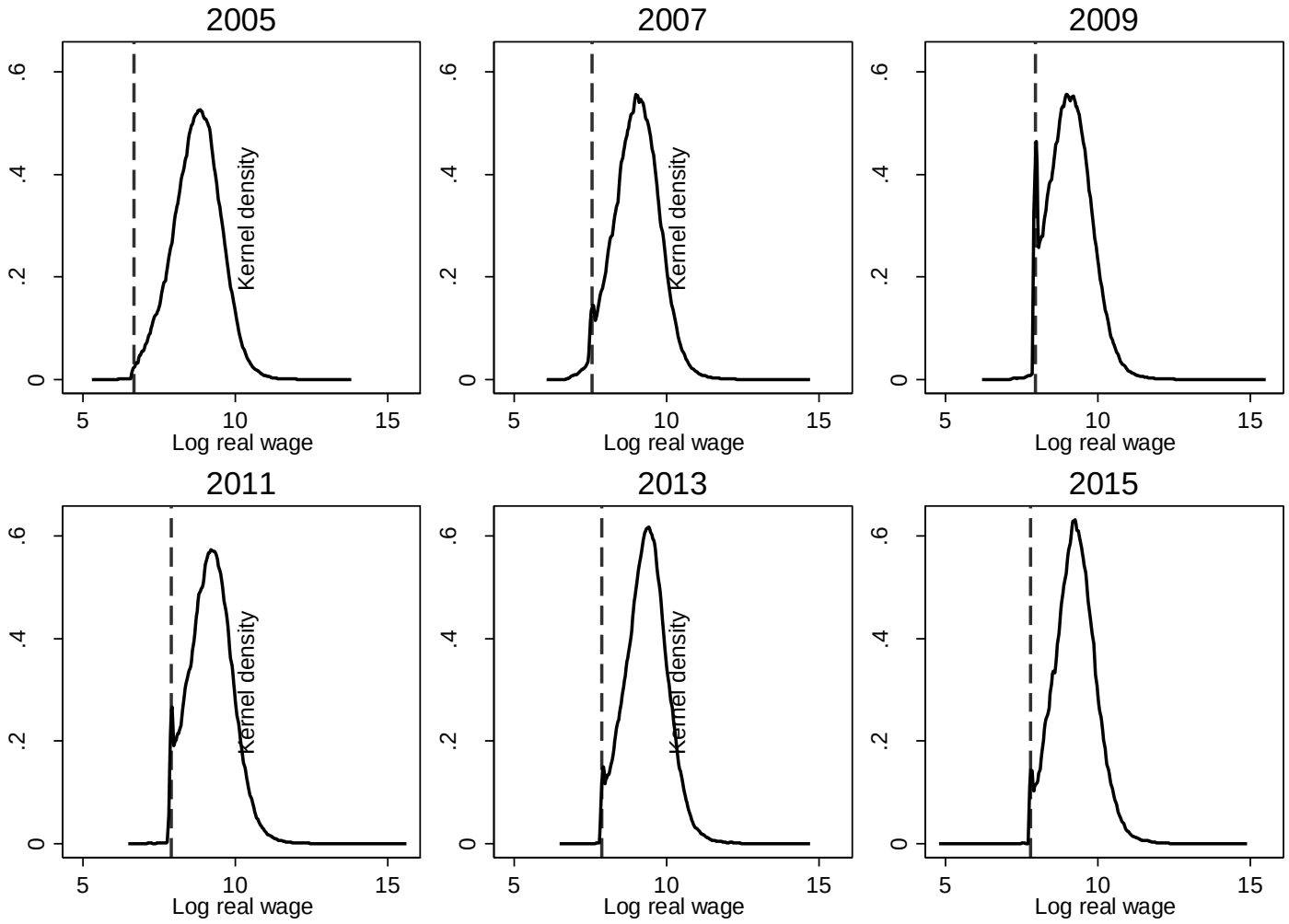

Fig. 5A. Kernel log real wage distributions

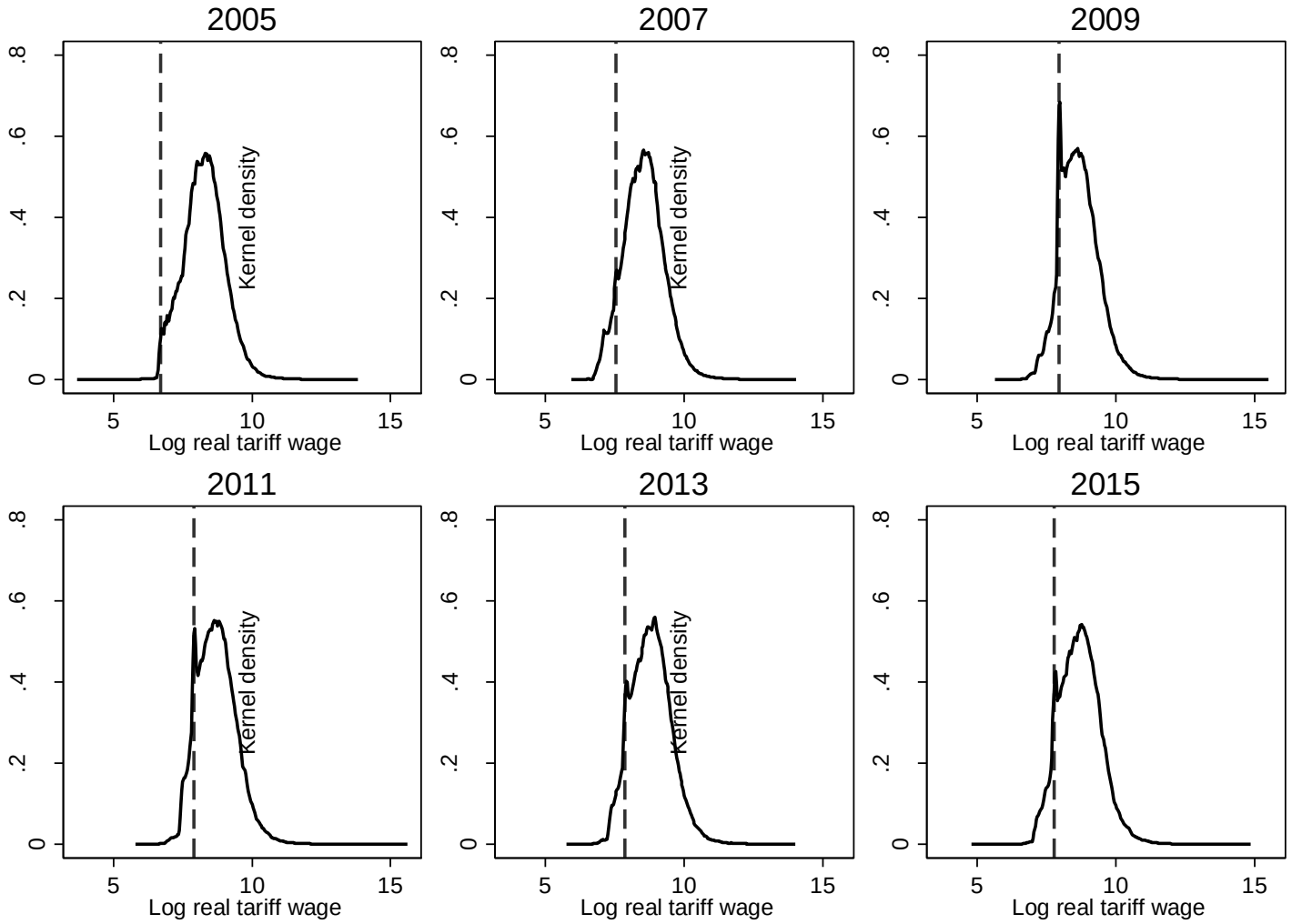

Fig. 5B. Kernel distributions for log real tariff wages